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referred to the original. He next describes a method of mixing colors with the stroboscope, which, in principle, is similar to that of the color top, and might occasionally prove useful. Next follows an application of the stroboscope to the demonstration of simultaneous contrast. Suppose, for simplicity, a stroboscope disk with four slits, two of which (lying in the same diameter) are covered with red glass, the other two being left free. Opposite the stroboscopic disk, on the same axis, is placed a white disk carrying two small black circles. When this combination of disks is set in rapid rotation, the observer sees a white or light red field, in which four dots appear to lie, two red brown and two green, the latter colored by contrast. [Such an experiment seems, like many of Hering's, to speak emphatically for the physiological theory of simultaneous contrast.] A fourth experiment of a more psychological character is the following: A series of stroboscopic pictures in black and white, representing boys playing leap-frog, was taken, and, after it had been viewed for a short time with the stroboscope, the pictures representing one boy in the air exactly over the other, were changed by covering the boy in the air with white paper, those showing the initial and concluding stages of the leap remaining unchanged. The alteration, however, made no difference whatever in the conviction of the observer that he actually saw one boy in the air above the other. Indeed, the suggestion involved in the mere beginning of the spring was sufficient to cause the seeing of the whole of it. A very inviting means is thus offered — as the author points out — for the study of suggested illusion and hallucination. [Work along this line has apparently already been undertaken at Cornell; see page 414 of this JOURNAL.]

Pedagogisch-psychometrische Studien. Zwei vorläufige Mitteilungen.
DR. ROBERT KELLER in Winterthur. Biol. Centralblatt. Bd.
XIV., No. 1, 2 and 9.

The present study was suggested by Mosso's experiments upon the influence of mental work upon the ergographic fatigue curve. If fatigue is due to a general deterioration of the blood, we may expect it to affect the muscles and that we may find a test, and possibly a measure of it, in the ergograph record. The latter may not be without value as a test of mental fatigue, even if this is of a more local character, since we may expect the strength and number of the impulses sent down by the brain to be diminished by it. In fact, may it not be possible to determine by this method the relative difficulty and the best grouping of studies in schools? The experiments are few in number and were all made upon a boy of fourteen.

The aim of the first is to study the effect of rapid reading upon the ergograph record. The general plan of an experiment is about the same throughout. Four ergograph records were taken, with intervals of about half an hour. A part of these intervals was spent in rapid reading, or other fatigue work. An hour's rest was then taken and an exactly similar experiment begun. Two experiments were made in the morning, and one, sometimes two, in the afternoon. The general result is that rapid reading at first increases, then lessens the ergograph record, and that the record after the hour's rest is usually lower than the fourth record. The fact that this order is repeated in successive experiments on the same day is some guarantee for a causal relation between mental work and changes in the ergograph record. It is also in harmony with Mosso's results. Similar experiments with the rapid reading

of Latin give similar variations, only fatigue appears more quickly. The effect of singing was studied in two experiments. In this case the period of increased activity drops out. In the second preliminary communication, the influence of reading numbers is studied. This work seems to lessen all the ergograph records in the first two experiments, but, in a third, to have the same effect as reading. This may be explained as due to the fact that practice diminishes the fatigue resulting from a given amount of work. The most important thing in these articles is the suggested application of this method of studying fatigue to pedagogical problems. J. A. B.

Recherches sur la localisation des sensations tactiles. Par M. VICTOR HENRI. Archives de Physiol. norm. et Path., No. 4, Oct. 1893.

Where one considers the localization of two points, the results of Weber's circles are considered good, but where only one is to be located, M. Henri thinks the best way is to do it on a photograph or by word. The photographic method was chosen. It was found that the error in direction was nearly constant for any single point of contact. The experiments on the dorsal surface of the fingers of the right hand show that there is a general tendency to locate the points of contact too near the end of the finger. At the end of the finger, however, the tendency is in the opposite direction, though the size of the errors is very much less. There are also some other points at the beginning of the second phalanx similar to the end of the finger. The errors in the transverse direction are of significance only in rare cases. If the point is placed on the side of the finger, instead of in the middle, the error is easily recognized. For any one point the error in localization is very limited, but it varies between 10 and 2 mm. for different points touched. The corresponding parts of different fingers do not vary appreciably. The middle of the first and second phalanges shows the greatest errors in localization, namely, 10 and 8 mm. Near the wrinkles (at the joints), which separate the two phalanges, the errors are equal to 4 or 5 mm. On the wrinkles and on the third phalanx their minimal value, which is 2 or 3 mm., is reached. At other points, however, they are even less than this. One subject found difficulty in distinguishing between points on the ring finger and those on the middle finger, though the amount of error in either case was constant. The difficulty disappeared in moving either of the fingers slightly. On the palm of the hand and at the commencement of the arm, the errors were different in direction and extent. The direction of error was always towards the part which separated the lower arm from the wrist, while the amount of error varied between 5 and 40 mm., being least when the point of touch was nearest this part and greatest in the reverse.

The conclusions from the experiments on three subjects are: (1) Where points are touched on the skin, they are located on the photograph at a point which, in relation to the touched point, is almost constant in direction. (2) Almost always the point indicated on the photograph is more near to a certain wrinkle or fold of the skin (*e. g.*, when there is a joint below) than is the point touched. (3) As the point of contact approaches this wrinkle the errors in localization decrease.

This shows us that all the points where we can localize a touched point are included on the inside of a fixed curve, which the point touched, as a rule on the inside of it, does not meet. Hence two elements of the curve can vary, namely, the size of it and also the distance from its centre to the point touched. These two elements